ONTARIO
FISH AND WILDLIFE
REVIEW

Volume Seven, Numbers One and Two Spring-Summer, 1968

ONTARIO
DEPARTMENT OF LANDS AND FORESTS
HON. RENE BRUNELLE, MINISTER G.H.U. BAYLY, DEPUTY MINISTER

ONTARIO
FISH AND WILDLIFE
REVIEW

Volume Seven, Numbers One and Two Spring-Summer, 1968

CONTENTS PAGE

THE COVER

All hail the Giant Canadas, now being re-established. Blair Dawson tells how it's going to be, Page 3. On the cover is his favourite shot of a breeding pair at the goose management area on Lake St. Lawrence. On the back cover, he poses for Harry Lumsden in southwestern Saskatchewan with two of the largest geese in the world.

ONTARIO FISH AND WILDLIFE REVIEW is published four times per year by the Department of Lands and Forests (Fish and Wildlife Branch), Parliament Buildings, Toronto 5, Ontario.

Management Programs Cost Money

With each passing year, our society is becoming more affluent and blessed with more leisure time. At the same time, people are becoming increasingly concentrated in urban areas. Under these conditions, the demands for outdoor recreation are expanding while the areas, where the more primitive outdoor pursuits such as hunting, fish and bird watching can be carried out, are slowly but surely shrinking in size and in number. This is particularly true in close proximity to the cities where those areas that remain available are being subjected in many cases to maximum or even excessive use.

It is now necessary to carry out intensive fish and wildlife management programs, some of which are expensive. It is also necessary to conduct continuing research programs on important fish and wildlife species. Thus, it is imperative to have more revenue provided for resource management. The obvious and fairest way for this to be accomplished is by passing along a significant proportion of the cost of management and research to those who specifically derive pleasure and satisfaction from a particular outdoor pursuit such as moose or deer hunting or angling. It was following this line of thinking that the Ontario government decided to increase small game hunting licences from one to three dollars, deer licences from five to ten dollars, moose licences from ten to fifteen dollars, and to implement a three-dollar resident angling licence.

With the increased revenues which will accrue, the Department of Lands and Forests will be able to intensify present programs such as deer range improvement, moose censuses, public hunting and fishing ground purchases and management, and Hungarian partridge propagation and stocking, and to conduct new programs such as giant Canada goose rehabilitation, landowner assistance, and fish and wildlife access road construction.

Extensive and intensive programs of management and research will ensure that we maintain our fish and wildlife heritage.

Geese are quick to learn the location of sanctuaries.

GIANTS OF THE GOOSE WORLD RETURN TO ONTARIO

by J.B. Dawson
Upland Game and Waterfowl Biologist, Game Management Sub-Section
(Photos by the Author)

LISTEN! A distant murmuring to the south changes rapidly to a musical clamour as a skein of geese appears in a wind-blown April sky. LOOK! A flock of large, powerful, white-cheeked birds wheel toward the carefully set decoys—and then change their minds. Canadas! What species of wildlife stirs the emotions more? Is it their size, beauty, intelligence, or do we earthbound humans secretly envy these wild continental travellers as they move from their nesting grounds on the muskeg to their winter homes in the "sunny south"? Whatever the reasons, Canada geese have a host of admirers.

Most of the migrating honkers seen by Ontario residents are either the Hudsons Bay Canada goose or Atlantic Canada goose, sub-species which traditionally nest in the "land of little trees"—the lowlands of James and Hudsons Bays. Few nest in southern Ontario where, even when captured and kept in captivity for long periods, these wild migrants frequently refuse to take family rearing responsibilities seriously, and fail to nest. A similar situation prevails across the continent. The fertile prairies of the west, which supply such a high proportion of the continent's annual crop of ducks, do not produce large numbers of Canada geese. There, too, most migrating Canadas continue northward to nest in the sub-Arctic.

Historically, Canada geese did nest in more southern climes. The Giant Canada goose, a very large, light-coloured race, once nested across the southern Canadian prairies, the northern prairie states, and eastward through the lake states into southwestern Ontario. Although Giant Canadas never were abundant, old-time western gunners knew this goose well. It was a large, pale Canada with a wing spread frequently exceeding six feet, and often weighing from twelve to eighteen pounds. There are reliable records of individuals exceeding twenty pounds. Compared to the more abundant Hudsons Bay and Atlantic Canadas, which rarely surpass ten pounds in weight, these geese were giants, indeed.

By the early part of the century, the big geese were becoming rare, and, from the early 1930's to 1962, they were considered to be extinct. During this period, scientists nostalgically inspected the few specimens of these geese which were resting in museums; many glowing epitaphs were written on *Branta canadensis maxima*, the largest wild goose in the world.

REDISCOVERY

One wintry day in January of 1962, a scientist from the Illinois Natural History Survey, Dr. Harold Hanson, made a startling discovery. He and other game workers started to weigh a sample of large Canada geese captured from a flock which over-winters within the town of Rochester, Minnesota. The scales appeared to be faulty but, to make certain, the crew retired to a nearby store to buy

some groceries of known weight. Amazingly, the "impossible weights" were verified. Only then did the crew know beyond question that they were dealing with a very large race of Canada geese. Subsequent investigations by Dr. Hanson showed that these were indeed Giant Canadas. *Branta canadensis maxima* was not extinct!

The rediscovery of the Giant Canadas solved some perplexing mysteries. It explained why some strains of geese, owned by private individuals and government game farms, nested successfully, while others did not. Dr. Hanson has shown that most, if not all, successfully reproducing populations of Canada geese, in southern Canada and the northern states east of the Continental Divide, are Giant Canadas. Most of these populations have originated from stock saved from extinction by game breeders, many of whom formerly had kept them for decoys. Many of the geese breeding on Federal refuges in North Dakota are descendants of one old 18-pound gander and its mate owned by a waterfowl hobbyist in Jamestown, North Dakota. Similarly, several flocks in the east are descendants of "maximas" raised at the state game farm at Mason, Michigan.

In Ontario, the flock established in 1959, on the newly flooded shores of Lake St. Lawrence, came from this Michigan stock. Augmented by Canadas released by the New York Conservation Department on a management area directly across the St. Lawrence, these birds have prospered. Resident geese now number over 1,000, and over 500 goslings were produced last year. The flock is still growing.

The rediscovery of the Giant Canada, which will breed so successfully in southern latitudes, has exciting mangement possibilities. Could these game birds be established all across southern Ontario? The answer is yes, and this the Ontario Department of Lands and Forests and the Ontario Waterfowl Re-

Devoted parents, the Giant Canadas usually raise families of from four to six.

search Foundation are attempting to do. The following briefly outlines the basic five-year cooperative program initiated this spring.

EGGS AND INCUBATION

Over 400 Giant Canada eggs were acquired this spring and incubated artificially at Niska, the Ontario Waterfowl Research Foundation's station located near Guelph. Eggs were obtained from flocks on Lake St. Lawrence, from Toronto Harbour, and from a large captive flock owned by the Department of Lands and Forests near Amherstburg in Essex County. Full clutches (usually five or six) were taken from some nests, while individual eggs were removed from others and replaced with dummy eggs. Many geese lay second clutches if the first is lost so that these egg thefts did not seriously affect normal production. Present Ontario sources should yield an even higher number of eggs annually for the duration of the initial five-year program.

REARING

Since the majority of "maximas" will not breed until their third year of life, it is important to take the best possible care of these valuable birds. Young goslings will be rendered permanently flightless by pinioning one wing. These geese will be maintained at Niska and at Department of Lands and Forests facilities, including sanctuaries associated with public hunting grounds which are either operational or under development.

RELEASE

Breeding pairs of "maxima" geese will be made available to selected, private cooperators who have water areas suitable for nesting geese. Landowners who wish to cooperate should contact their local Lands and Forests district office. If the conditions outlined appear suitable, properties then will be inspected either by Lands and Forests wildlife biologists or personnel of the Ontario Waterfowl Research Foundation.

In the early stages of the program, as many cooperators as possible will be sought in one key area of southwestern Ontario:- Wellington, Waterloo and south Grey Counties. This area already has two pioneering flocks of large Canadas, one at Niska in Wellington County, and the other originating from the adjacent farms of John and James Calder at Holstein in south Grey County. Sufficient pairs may be available for release on private wetlands elsewhere in southern Ontario, but this will depend upon the supply of geese and the number of cooperators in the "key" area.

Large publicly-owned wetlands will play an important part in the release program. Intensive management will be possible on Tiny Marsh and Wye Lake in Simcoe County and in other large wetlands, some of which are beign purchased throught the Department's land acquisition program.

All requests for mated pairs of Giant Canadas will be carefully scrutinized by a committee of Ontario Waterfowl Research Foundation and Lands and Forests personnel. Following decisions as to the best locations for geese, the O.W.R.F. will distribute breeding pairs of geese and advise to their care and management.

NESTING FACILITIES

Canada geese do not mature until their second or third year, and pairs will be at least two years old before they are distributed. Pinioned pairs need open

Figure 1. An elevated platform with bales of straw---a nest site safe from predators and fluctuating water levels on Lake St. Lawrence goose management area.

water to escape predators, and protected nesting sites, such as islands or artificial nesting structures, are favoured. Farm ponds or marshes, as small as one-quarter acre, are suitable if nest sites are available.

Man-made nesting facilities will play an important role in establishing "maximas" in southern Ontario. Geese, and other waterfowl, seek out nesting sites similar to those where they were hatched. This behaviour, the result of imprinting, can be used effectively to ensure that nests are ideally located and safe from predation or water-level fluctuations. Various types of structures have been used successfully. Wash tubs, wooden boxes and platforms and even discarded automobile tires, placed in suitable locations, have been used as nest sites by Giant Canadas. Two such structures are illustrated in Figures 1 and 2.

The modernistic model shown in Figure 2 is made of fibreglass and specifically manufactured for Canada geese. It is light, durable, easily installed, and completely predator-proof. The Department of Lands and Forests plans to make this type of structure available to cooperators at cost.

IMPRINTING

Incubated goslings will be imprinted to these structures. This will be accomplished at Niska by placing newly hatched geese in the fibreglass nesting baskets during their first 24 hours of life and forcing them to jump down several times into water below the basket. Many geese, so imprinted as goslings, will use these

Figure 2. A fibreglass nesting structure manufactured especially for Canada geese. Light and durable, it provides a predator-proof nesting site.

baskets as nesting locations when they become mature.

The imprinting of young geese to nest structures can be an important tool of management. Geese mate for life, and both parents zealously guard the nest and the immediate vicinity. Ganders frequently "stake out a claim" of considerable size, and woe betide the intruder, goose or otherwise, who ventures into this territory. Nesting platforms or baskets have the advantage that ganders tend to guard a much smaller area, particularly if there is a resting spot nearby. On one management area in Ohio, two boards were placed on either side of nest boxes to serve as lookouts for pugnacious male geese. The "gander landers" markedly reduce the territory defended, allowing a much higher number of nests that would otherwise be possible.

Geese can be so strongly imprinted to man-made nesting structures that they will nest on virtually nothing else. This was aptly demonstrated on a Missouri waterfowl refuge where Giant Canadas had nested in old automobile tires placed out for this purpose. In spring, all possible goose nesting sites had been taken by homemaking pairs, and to prove a point, the refuge manager threw a tire up on the roof of the refuge headquarters. Within one hour, two pairs were fighting over the newest home site!

Scarcity of suitable nesting sites could limit the density of southern breeding Canada geese. In release areas, as imprinted two-year-olds pair and begin searching for nesting sites, cooperating sportsmen's groups or naturalists can

participate by placing artificial nesting structures on or near suitable wetlands. Once a "core" area has become saturated with nesting geese, the use of these structures should rapidly increase. The Ontario Lake St. Lawrence flock (which has had problems with nest flooding) started to use man-made platforms first in 1962. In the past three years, use of nesting platforms has increased every year from 10 in 1966 to 19 in 1967 to 23 in 1968.

STUMBLING BLOCKS

There are obstacles which must be overcome if Giant Canadas are to be re-established in southern Ontario. Pinioned geese need to be cared for in winter. Although open water is not an absolute necessity for over-wintering geese, windbreaks and protection from marauding dogs and other predators are necessary. Some cooperators may not have adequate facilities, and winter homes must be found for these valuable adult breeders. Young geese can be allowed to fly free, and these will undoubtedly seek out open water, either in Ontario or south of the border.

Care must be taken that releases of geese do not interfere with the hunting of other waterfowl. Federal regulations prohibit waterfowl hunting within one-quarter mile of baited areas or live decoys. Release of geese on areas now unimportant as hunting locations (such as farm ponds), and the confinement of pinioned birds to restricted areas of larger wetlands during the gunning season, will be necessary. Public access to waterfowl marshes in southern Ontario is limited, and care must be taken to ensure that the release of Giant Canada geese does not add to this problem.

During the initial years of the re-establishment program, geese will need as much protection as possible. Refuges associated with large public wetlands (as on the St. Lawrence) will be important in this respect. Where a large number of private cooperators are involved in certain key areas, it may be necessary to restrict goose hunting for several years to allow local populations of geese to become established. This would only be practical in countries where goose hunting opportunities are either not available or very much restricted at the present time.

Some nesting geese will be predated by vandals, an expression of human behaviour which is difficult to explain. Whether the re-establishment program succeeds or fails will depend upon the degree to which the general public affords protection to nesting geese. Protection by an interested public, and release of sufficient numbers of breeding geese to off-set inevitable losses, will be the key to the program's success.

HUNTING PROSPECTS

Given a chance to multiply, home-grown honkers will provide good hunting in a comparatively few years. Initially, however, hunters should realize that a bird in the bush is worth two in the hand. They should consider that, once established, resident flocks will attract large numbers of migrating Canadas, which now are largely unavailable to southern Ontario gunners.

Giant Canada geese *can* be re-established in southern Ontario. This will take time, effort and the active cooperation of a great many people. Ontario will be the richer, however, if success is achieved in bringing back *Branta canadensis maxima*, the largest goose in the world!

THE ONTARIO WATERFOWL RESEARCH FOUNDATION

by A.T. Cringan
Department of Zoology, University of Guelph

Ontario has more waterfowl hunters and a higher estimated waterfowl kill than any other Canadian province. In 1967, approximately 146,000 Ontario hunters took a harvest which has been estimated in excess of a million waterfowl.

The ducks and geese that constitute our major waterfowl resource have faced increasing numbers of hunters since the end of World War II. At the same time, they have suffered from pollution, from pesticides, and from the destruction of their habitat through such processes as drainage and urbanization.

In 1961, a group of business men and scientists, sharing a mutual concern for the welfare of this waterfowl resource, formed the Ontario Waterfowl Research Foundation. Their aim—waterfowl for tomorrow—to preserve this particular wildlife heritage for future generations.

Specific objectives of the Foundation are to develop public interest in waterfowl and public support for waterfowl management; to promote the training of waterfowl biologists and managers; and to support research on waterfowl and to make the results of that research available for application.

The Ontario Waterfowl Research Foundation is a non-profit, charitable Foundation financially supported by individuals, clubs and corporations, and by grants from governments. It is administered by a Board of Trustees. Mr. W.C. Harris of Toronto was the founding chairman of the board. The present chairman is Mr. H.M. Turner of Toronto. Others who have served in this office are Mr. W. Rankine Nesbitt of Toronto and Mrs. K.O. Hammill of Guelph.

A Board of Scientific Advisors, made up of representatives from the Canadian Wildlife Service, the Ontario Department of Lands and Forests, and from several of Ontario's universities, advises the Foundation on its research programm.

Through inter-locking memberships, contact is maintained with many other organizations concerned with waterfowl. These include the Conservation Council of Ontario, Federal and Provincial Government Agencies, the North American Wildlife Foundation, Ducks Unlimited (Canada), the Canadian Wildlife Federation, the Canadian Audubon Society, the Federation of Ontario Naturalists, and the Ontario Federation of Anglers and Hunters.

A milestone in the Foundation's development was the decision in 1962 to purchase the Niska Game Farm from the the estate of the late Horace G. Mack. This was a property of 110 acres, situated on the Speed River below Guelph, which had been developed as a private game sanctuary by Mr. Mack since 1947. It is within a larger Federal Migratory Bird Sanctuary, most of which is within the city limits of Guelph.

In 1963, W.H. Carrick, one of Canada's outstanding wildlife photographers, was engaged as manager of the Foundation's property. By 1965, under Bill Carrick's management, ten acres of the property had been intensively developed

Niska-reared geese, free on Georgian Bay. Photo by F.P. Maher.

along lines similar to those employed at the world-famous Severn Wildfowl Trust in Great Britain. This property, named the Kortright Waterfowl Park, is dedicated to Frances H. Kortright, founder of the Canadian National Sportsmen's Show. It has become a popular and educational attraction where visitors can observe waterfowl under natural conditions. Attendance in 1967 exceeded 10,000 persons, including hundreds of school children. Capital development of the Park was the centennial project of the Canadian National Sportsmen's Show.

The Niska Waterfowl Research Station also is maintained on the property. Research facilities include a library, a laboratory, incubators, brooders, and holding pens. This station is within two hours' driving time from Toronto, London, Hamilton, and Kitchener, and thus is readily available to eight of Ontario's universities.

The OWRF, in cooperation with other agencies, has supported research on the movement and migration of waterfowl in southwestern Ontario, on artificial nesting devices for waterfowl, on blood parasites and flukes of waterfowl, on the productivity of habitats and the energy requirements of ducks, and on the growth, development, and serology of the Canada goose. In addition, facilities have been made available for research on the nutrition of ruffed grouse, hardiness of the ring-necked pheasant, vision in hawks, and on the blood parasites of snapping turtles. Theses and papers, either completed or nearing completion, which have resulted from the Foundation's activities, are contributing substantially to resource management in Ontario.

The Giant Canada goose programme, aimed at restoration of breeding flocks in southern Ontario, is the largest single project yet undertaken by the Foundation. It is a cooperative venture between the OWRF and the Fish and Wildlife Branch of the Ontario Department of Lands and Forests. All concerned are confident that the sum total of the results of this new project, the educational value of the Kortright Waterfowl Park, and the results of basic scientific research, will bring Ontario one step closer toward the Foundation's goal—Waterfowl for Tomorrow.

FRESH-WATER CLAMMING

by R.E. Whitfield
Fish and Wildlife Supervisor, Tweed Forest District

Gourmets for centuries have glamorized the oyster, and to some extent the salt-water clam, until these marine forms have gained world-wide acceptance as a table delicacy—but not the fresh-water clam.

The harvest of fresh-water bivalves for table use in Ontario exists on a very limited basis, confined mostly to individuals of a venturesome and curious nature.

The extensive oyster and salt-water clam industry, well established in Europe and on both the east and west coasts of North America, undoubtedly has inspired some attempt at exploitation of the vast fresh-water clam resources. In the United States before the turn of the century, a large fresh-water clam industry was developed along the Mississippi River and its tributaries---- but not because of the meat; the shells, used in the manufacture of pearl buttons, were the main interest in this multi-million-dollar industry.

Louis Figuier of France has left a vivid and detailed account of the bivalves in European coastal waters and estuaries and of the trials and tribulations of those that consumed them. In his notes, prepared in 1869 for a book entitled "The Ocean World" (edited and revised by Percival Wright, Professor of Botany in the University of Dublin), published in 1891, Figuier writes as follows:

While commending the mussle (clam) as an important article of food, we must not conceal the fact that it has produced in certain persons very grave effects, showing that for them its flesh has the effects of poison. The symptoms, commonly observed two or three hours after repast, are weakness or torpor, constriction of the throat and swelling of the head, accompanied by great thirst, nausea, frequent vomitings, eruption of the skin and severe itching.

Figuier blamed this on parasites finding their way into the clams as well as inorganic substances that were found in the vicinity of the clam beds. He quotes a Mr. Bertram, author of "Harvest of the Sea", as saying:

He was a bold man who first ate an oyster.

Knowing the quality of oysters and salt-water clams, as opposed to fresh-water clams, we might add:

Bolder still was the man who first ate a fresh-water clam.

In an effort to determine why fresh-water clams are not more widely used, a search was made for individuals who had eaten them. Testimonials were easy to come by as many people had tried them at one time or another. Here is what one man had to say:

My wife and I came upon a clam bed while on a camping trip. We gathered some clams and roasted them over a fire on the end of a stick. We both ate one or two of the clams before we began to feel ill. Maybe it was just the thought of

eating something we hadn't eaten before; anyhow, we have never attempted to eat them since.

A resident of Long Point on Lake Erie had the following to report:

About 20 years ago while I was engaged in commercial fishing, I was seining in the inner bay of Long Point Bay; aside from the fish taken, each haul of the seine netted several bushels of clams. I picked out the finer specimens, washed them clean, and put them in salt brine----this opened them up so that I could take the meat out. My wife put up between three and four gallons of clam meat which we kept in a refrigerator. We ate and enjoyed it all. The black fringe on the edge of the clam (mantle) had to be removed or the clam meat would have a muddy taste.

When asked if clams were collected and eaten regularly, his answer was in the negative, with no special reasons offered.

In Prince Edward County, a commerfisherman said he had eaten fresh-water clams in the raw form as one would eat an oyster. He thought they tasted good, but admitted it was not a regular practice. In the same area, another commercial fisherman said he had collected clams, parboiled them in milk, and consumed them as a cure for stomach ulcers.

Most of these interviews had one point in common: the first attempt at eating fresh-water clams was also the last.

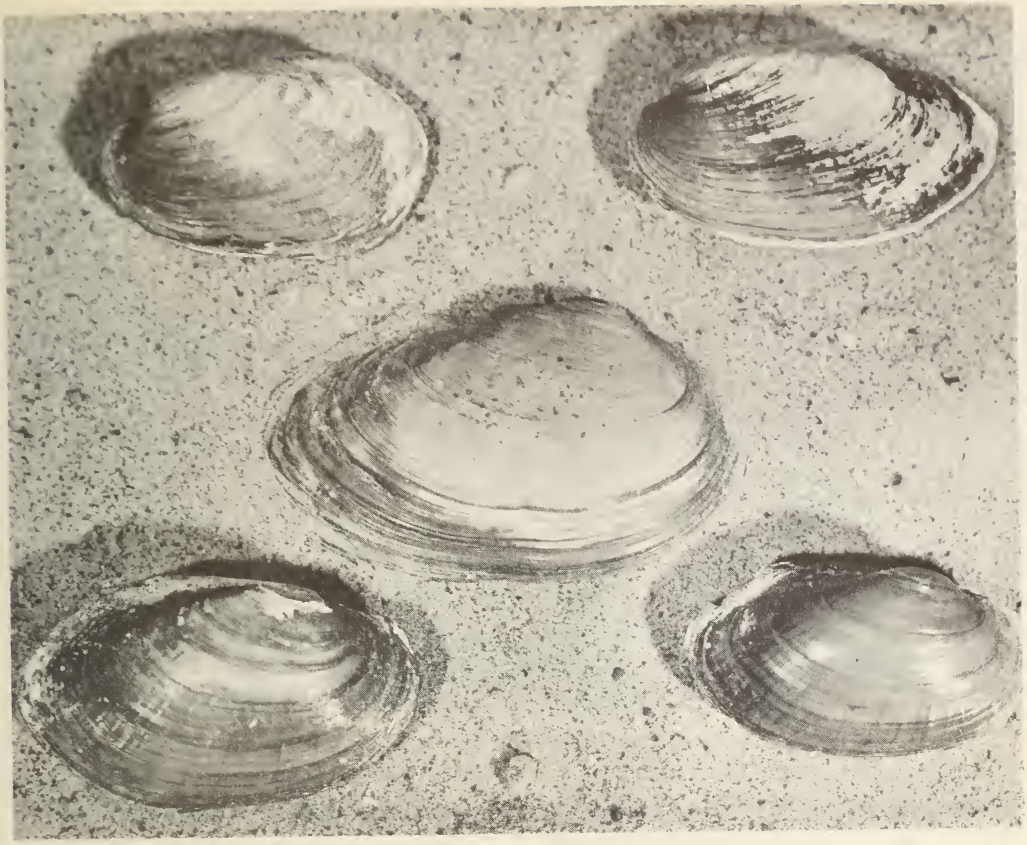
What is wrong with fresh-water clams? Why aren't they used more readily? They grow large and are more meaty than some of the East Coast oysters, and they are certainly larger than their cousins, the unquestionably edible salt-water clams.

The answer lies partly in the fact that the fresh-water clam is not as flavourful as the salt-water clam or the oyster. Secondly, one might venture to say that clam and oyster eaters are not born but made, especially in inland areas far from the sea.

In 1963, along with several colleagues, the writer visited The Thousand Islands Clam Corporation, a small fresh-water clam fishery. This had been recently established on the St. Lawrence River at Clayton, New York, by Gordon Hutchinson, a diver, following an unexpected demand for fresh-water clams. Our purpose was to discover the species of clams harvested, their distribution on the bed of the river, and the depth at which they were taken. We wished to determine if the industry might be established in the Canadian waters of the St. Lawrence.

Mr. Hutchinson informed us that the two main species harvested were *Lampsilis radiata* and *Eleptio complanatus*. Clam sizes varied considerably, but only those measuring 2½'' x 1¾'' were taken for market. Larger clams could well be utilized if they were to be canned for chowder, but for the fried or steamed form, the clam meat had to be kept to a size that could be swallowed in one piece rather than chewed.

The best sites for harvesting were found on sandy areas of the river bottom at depths ranging to about 30 feet. The clams were often in layers, one layer on top of the sand, and two more layers just below the surface. Except in the amount of cleaning required, there was little difference in the quality of the



Common Ontario fresh-water clams of the genus Lampsilis. *Photo by T. Jenkins.*

clams harvested above or below the surface of the sand.

The production of clams was limited by the method of harvest. Mr. Hutchinson, the firm's only diver, was obliged to remain at the bottom, to dig the clams out with his hands, and to fill baskets which were hauled to the surface by an assistant in a boat.

A new type of syphon dredge was being developed at the time of our visit. It consisted of a centrifugal by-pass pump (operated in a boat on the surface) and a six-inch plastic pipe that extended to the bottom. The bottom end of the intake pipe fitted into a steel framework to prevent it from "digging in". The apparatus was not completed but it promised to be much more efficient than hand digging.

After being sorted for size, freshly caught clams were placed in a rotating tumbler which removed algae and mud, leaving a glistening clean shell. Next, the clams were floated in fresh, cold water for three to four hours to allow the clam to eject any particles of sand or mud from inside the shell. Now ready for marketing, the clams were stored in deep freeze or in a refrigerator just above freezing.

Marketing was one of the major obstacles to be overcome, according to Mr. Hutchinson's associates. Locally they received 65 cents per dozen for clams (in the round), but they felt that the mar-

ket could be developed---possibly better inland than in coastal areas, such as New York City, where they encountered the competition of salt-water clams.

The firm's operations had been delayed by the State of New York until bacterial counts had been made in the area where harvesting was to be carried on. The State had then designated a portion of the St. Lawrence River on the New York side, from the Thousand Island Bridge to Fishers Landing, Clayton, as an exclusive area for the corporation to harvest clams. Commercial clamming in New York is allowed only in unpolluted areas designated by the state.

Our meeting with Mr. Hutchinson and his associates concluded with the sering of fresh-water clams prepared in various ways----clam chowder, fried clams and steamed clams. All these, to say the least, were most palatable, with no hint of off-flavour.

Five years later, on a second visit to Clayton in March, 1968, we were advised that The Thousand Islands Clam Corporation had ceased to function in 1964. Mr. Hutchinson said they were unable to raise sufficient funds to develop markets or efficient gear for harvesting. A fair volume of repeat sales was developed in local cities, such as Syracuse, N.Y., but not enough to support the industry on a full-time basis.

The short life of the corporation does not mean it did not produce a good and edible fresh-water clam product.

Ontario has a vast clam resource, little exploited except by wildlife species such as muskrat, raccoon, otter, mink and a few birds. But there is little doubt that it will take a great deal of time and effort to convince shellfish gourmets that they should accept the fresh-water clam.

THE BREEDING AND SUBSEQUENT FAWNING SEASON IN THE BRUCE PENINSULA DEER HERD

by W. Dan Mansell
Biologist, Lake Huron Forest District

It is common knowledge that white-tailed deer *(Odocoileus virginianus)* breed in the fall of the year, but no information is currently available on the peaks of breeding and fawning in Ontario. During the period, September 1, 1966, to June 30, 1967, a study on the reproductive biology of white-tailed deer was carried out on the Bruce Peninsula. One of its objectives was to provide an estimate of the breeding season of deer in this area.

An examination of the reproductive organs from female deer, shot in the fall by hunters, does not normally yield information applicable to the determination of breeding season. Because visible embryos are difficult to isolate in deer until about 30 days after pregnancy begins (Armstrong, 1950) and the major peak in breeding was suspected to be about the time the deer season was open, it was necessary to make a collection of pregnant does during late winter.

For this study, 22 does were shot in the Johnston Harbour deer yard (Figure 1), and all foeti that they contained were preserved. Then, the length of the foetus from forehead to rump (F-R, Figure 2) was obtained by measuring with calipers. These measurements are shown in Table 1. In cases of twins or triplets, the average F-R length was used in determining age.

The relation between the F-R length and age of the foetus was obtained from a study conducted by Cheatum and Morton (1946) in New York. These authors were able to remove foeti from penned females at known intervals of time after conception. The length of each foetus was plotted graphically against its age, and a statistical relationship was calculated and expressed in the form of a regression equation (Figure 3).

On the basis of the regression line obtained for New York deer, the ages of foeti found in the Bruce Peninsula deer were determined by comparing their F-R length with the length of the New York foeti. For example, an F-R length of 240 mm would indicate an age of 118 days.

In addition to providing an estimate of age, the regression equation also provides an estimate of the minimum and maximum ages that one would expect from any given length.

The estimated dates of conception (breeding dates) were then obtained by subtracting the range of possible ages of each foetus from the date on which it was collected. Then, each range of dates was plotted so that a distribution of breeding dates was constructed for examination (Figure 4).

Consequently, it was determined that the peak of breeding activity during 1967 occurred between November 11 and 18.

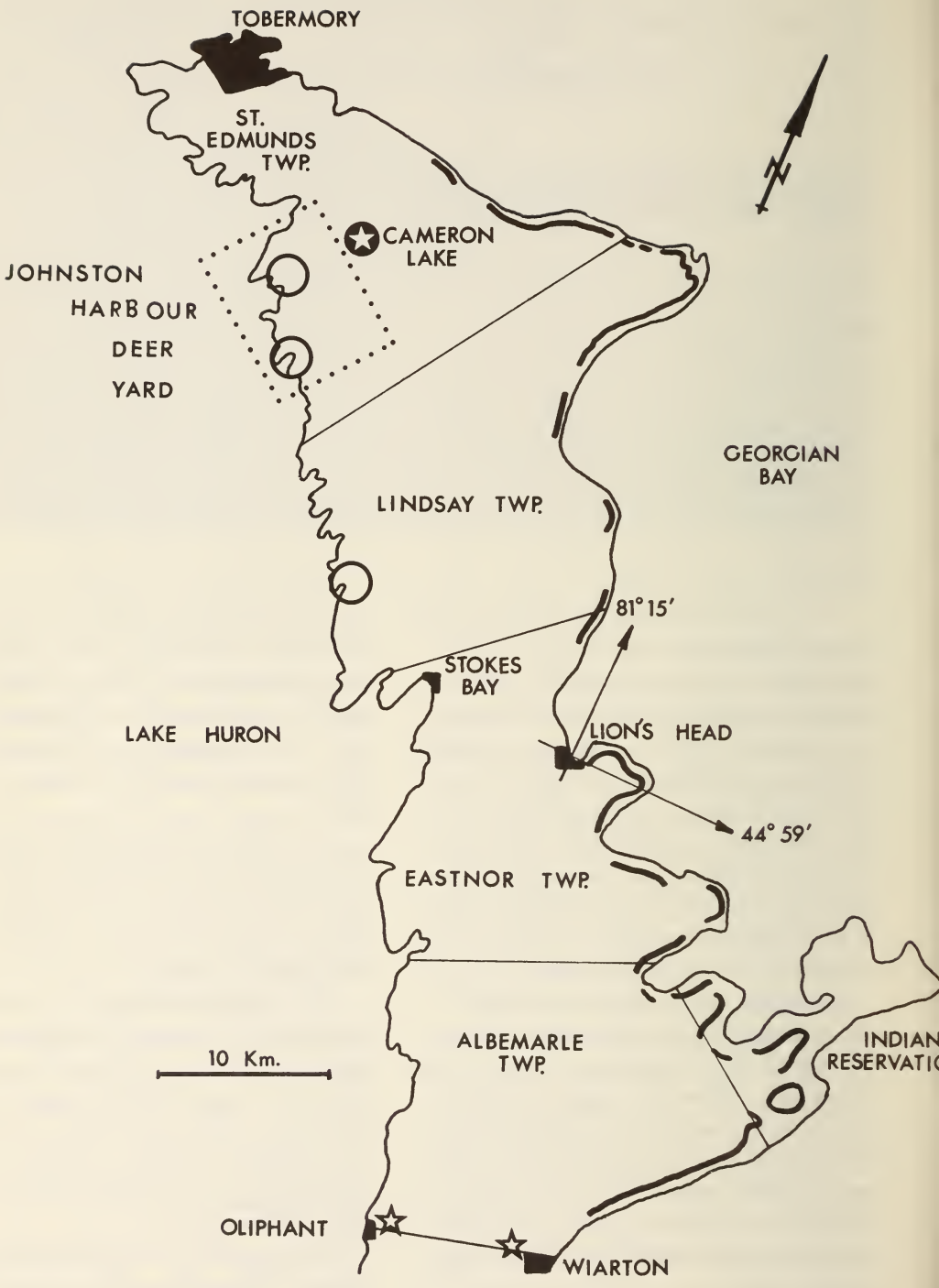


Figure 1. The Bruce Peninsula study area.

Number of Foeti	Forehead-Rump Length in mm	Calculated Age in Days* Lower Limit	Average	Upper Limit
1	76	48	55	62
1	92	55	61	67
2	111	62	68	74
1	117	64	70	76
2	119	62	69	76
1	149-161**	76	84	92
1	161	81	86	91
2	177	86	91	96
2	182-198**	88	96	104
1	192	92	96	101
2	198	94	98	103
1	199	95	100	104
1	214	100	104	108
2	217	101	105	109
2	236	108	112	116
1	242	111	115	119
2	244	112	116	120
1	261	117	121	125
2	273	121	126	130
1	274	122	126	131
1	282	125	130	134
2	353	149	154	160

* – based on the equation $\hat{Y} = -77.5 + 2.80 \times$ (SE = 5.80)
** – based on the equation $\hat{Y} = 47.4 + 15.6 \times$ (SE = 1.73)

Duration of the breeding season included the period, November 3 to December 31. The period, December 15 to 31, is likely the result of two factors: (a) Adult does being bred during a second heat period as a result of non-conception in mid-November; and (b) the typical late breeding which is characteristic of does breeding for the first time.

Fawning dates were obtained by adding 200 days (the average gestation period of northern white-tailed deer) to the dates of conception. Using this technique, it was calculated that the fawning season on the Bruce Peninsula lasts from May 21 to July 19 with the majority of fawns being born between May 30 and July 19.

It is no secret that to have successful breeding both sexes must take part. Eight males were collected during the study, and their reproductive organs

ing of the breeding season. He maintained that this selection favoured those animals whose young were born at a time of year in which survival was the highest.

Other workers, dealing with sheep, which are distantly related to deer, are of the opinion that decreasing amounts of sunlight, as occurs in the fall, is of ultimate importance in triggering the annual breeding season. Yeates (1949) found that the breeding season of Suffolk sheep started 10 to 14 weeks after the change-over from the longest day to decreasing daylight hours. On the other hand, Dutt and Bush (1955) were able to

were examined to determine if they were in a productive state. Presence of sperm in the seminal vesicles would indicate a state of productivity (Figure 5a), while absence of sperm would indicate a state of quiescence (figure 5b). As a result of this study, it was concluded that most bucks had lost their potency by February 24 and would be unable to carry out successful breeding until late summer.

What factors determine the onset of rut and oestrous cycle of deer? There are various hypotheses. Bullough (1951) postulated that natural selection was the ultimate process responsible for the tim-

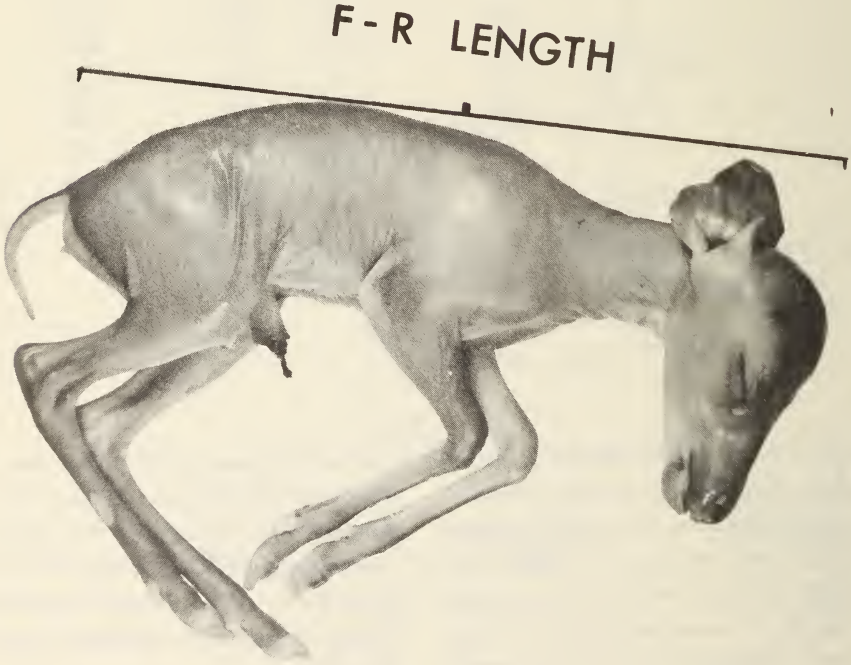


Figure 2. A normal foetus of white-tailed deer at about 130 days gestation showing the forehead-rump length (1/10 life size).

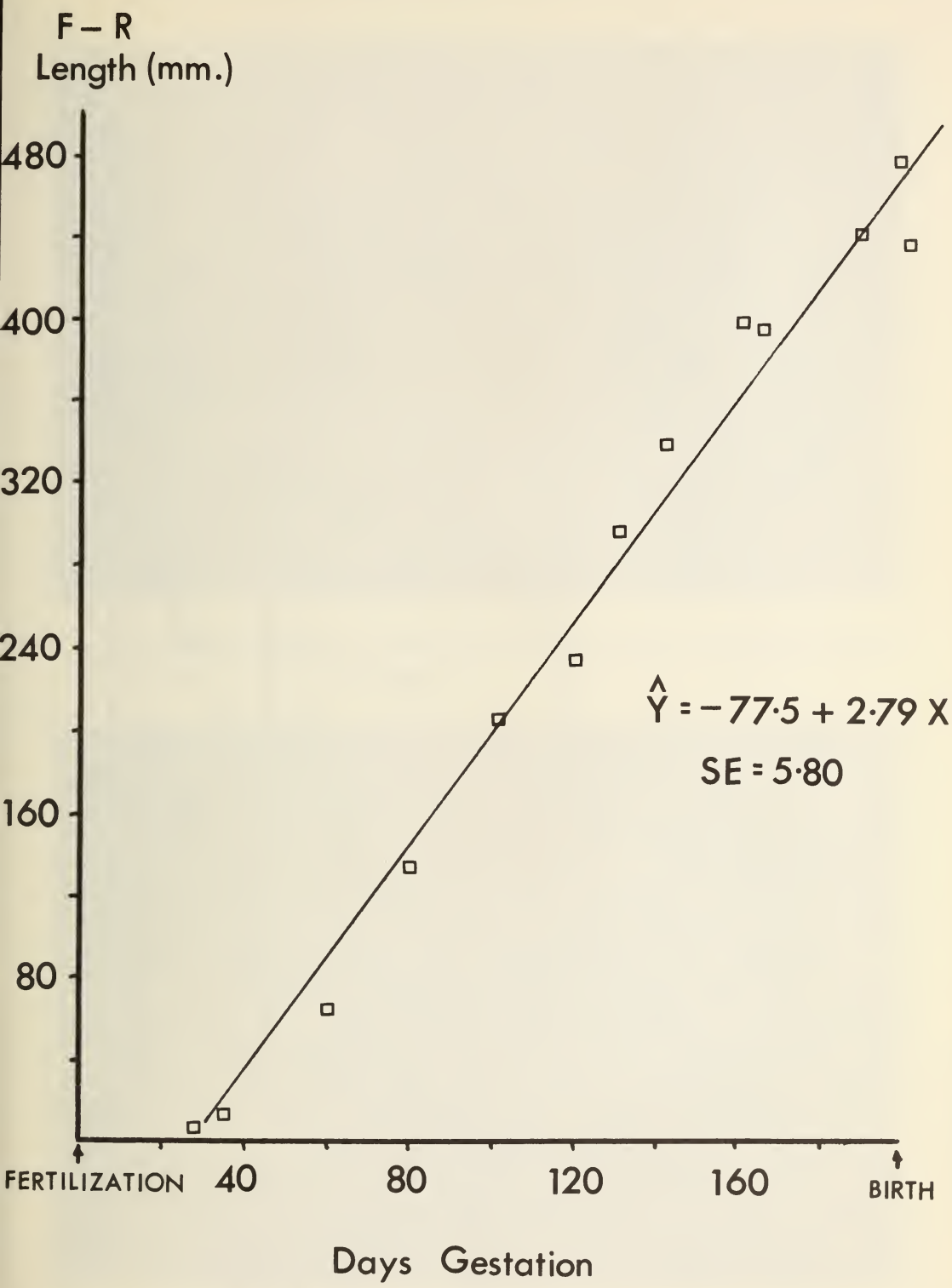


Figure 3. The regression of forehead-rump length on known ages of white-tailed deer foeti.

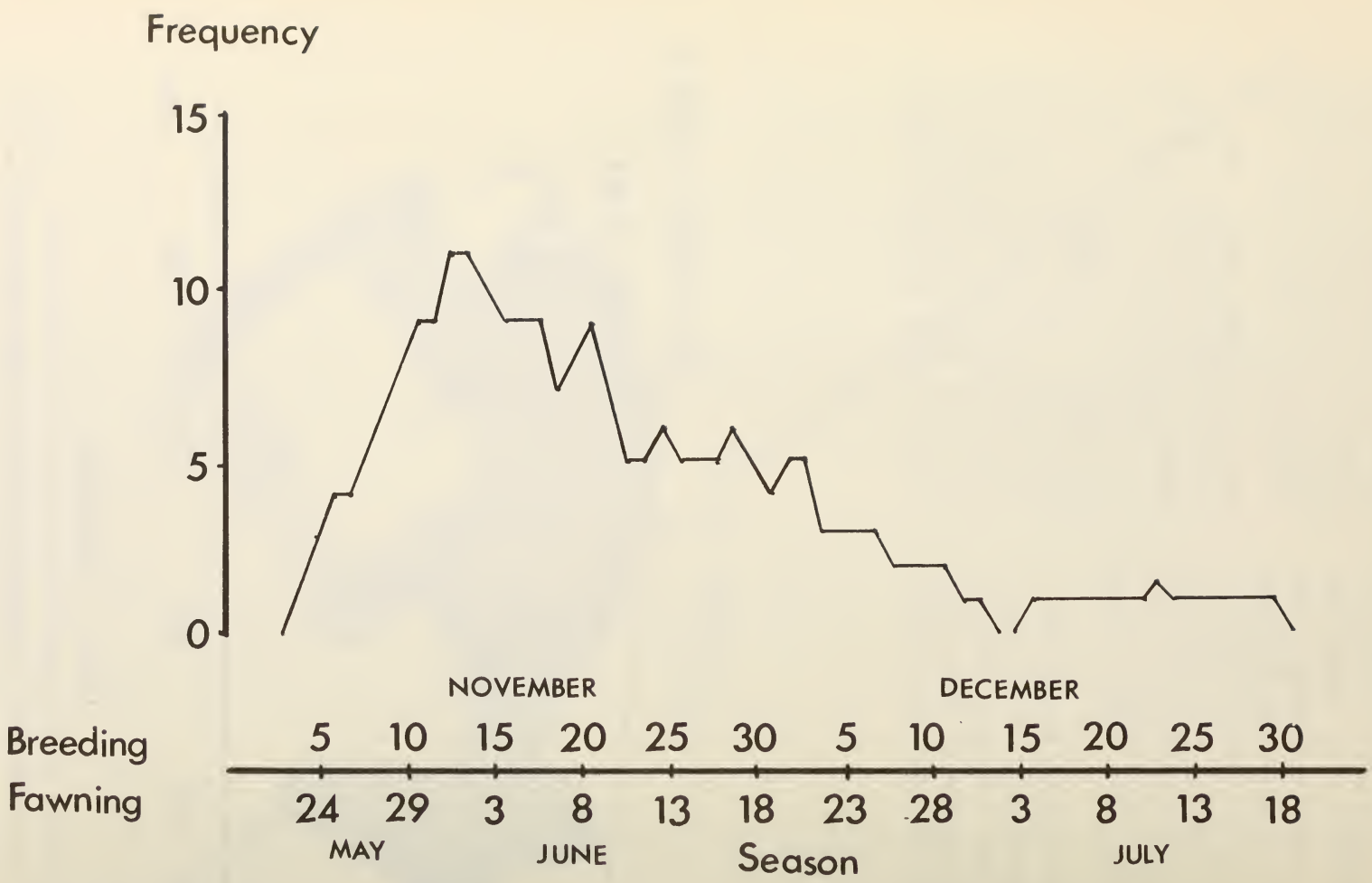


Figure 4. The breeding and subsequent fawning season of white-tailed deer on Bruce Peninsula obtained by back-dating the estimated ages of 32 foeti.

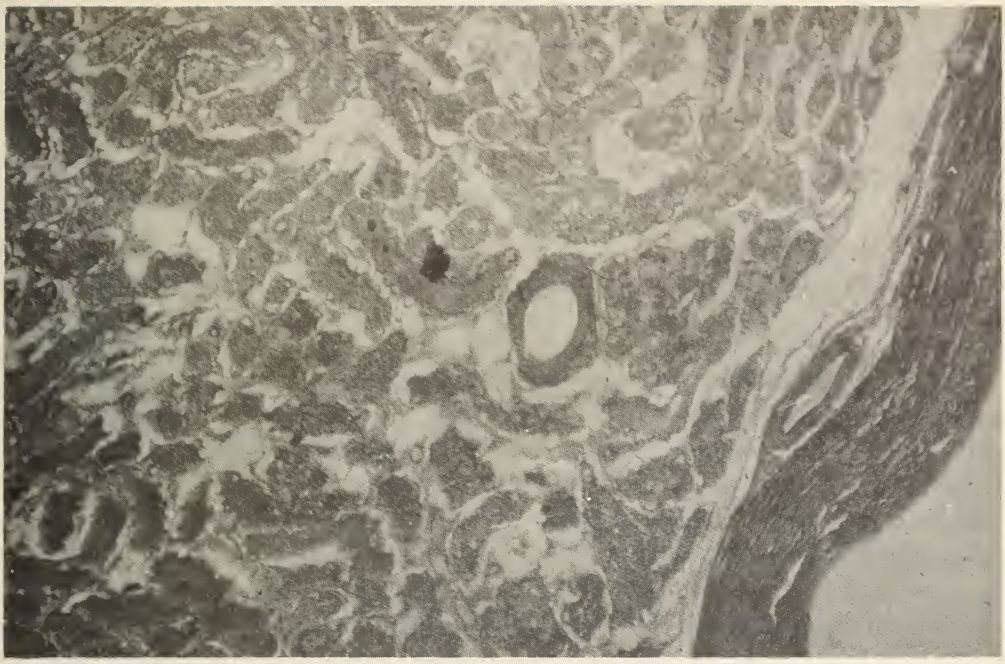


Figure 5a. Section through the seminal vesicles of a productive male deer showing the sperm-filled lumen(80x).

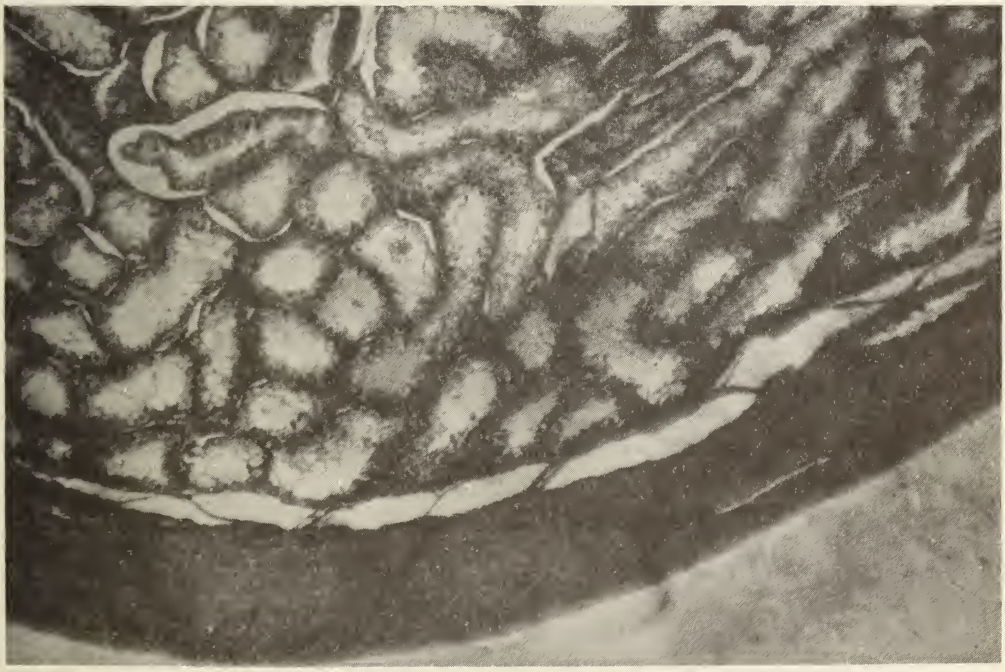


Figure 5b. Section through the seminal vesicles of a male deer in the quiescent stage with very apparent, empty lumen (80x).

advance the onset of breeding in sheep by 30 to 40 days by exposing them to an environmental temperature of 45°F. while keeping them under normal daylight. It would appear that day-length and temperature are both important factors contributing to the timing of the onset of oestrous and, thus, the time when breeding occurs.

Deer also show a relationship between breeding activity and latitude. For instance, when red deer were transferred from New Zealand to England, that is, from the southern to northern hemisphere, the peak of their breeding season changed from April to December over a two-year transition period (Taylor, 1956). This presumably was a response to change in day length.

The peak of breeding activity in deer varies not only between different subspecies but also between different ages. Normally, older deer become sexually active earlier in the season than do younger deer.

In New York State, where considerable work on deer reproduction has been done, Cheatum and Morton (1946) found that most fawns bred four weeks later than most adults. On the Bruce Peninsula, the peak of breeding in adult does was around November 20, while the peak of breeding in yearlings was three weeks later, about December 11.

From the foregoing, it can be seen that several factors exert an influence in determining the time of the breeding season, and it is difficult to generalize on which is the most important. Specific studies, such as this one on the Bruce Peninsula, add to our knowledge of the biology of deer and enable us to carry out better deer management based on biological facts.

REFERENCES

Armstrong, Ruth A. 1950. Foetal development of the northern white-tailed deer (*Odocoileus virginianus borealis* Miller). Am. Midland Nat. 43:650-666.

Bullough, W.S. 1951. Vertebrate sexual cycles. Methuen and Co. Ltd., London. 117 pp.

Cheatum, E.L. and G.H. Morton. 1946. Breeding season of white-tailed deer in New York. J. Wildl. Mgmt. 10:249-263.

Dutt, R.H. and L.F. Bush. 1955. The effect of low environmental temperature on initiation of the breeding season and fertility in sheep. J. Anim. Sci. 14:885-896.

Taylor, W.D. (ed). 1956. The Deer Monage of North America. Their History and management. The Stackpole Co., Harrisburg, Pa. and the Wildl. Mgmt. Inst., Wash., D.C. 668 pp.

Yeates, N.T.M. 1949. The breeding season of sheep, with special reference to its modification by artificial means using light. J. Agr. Sci. 39:1-43.

TABLE 1. The forehead-rump lengths of 32 foeti and the estimated age in days, based on a regression analysis of known-age foeti.

SO YOU WANT TO BE A TROUT FARMER?

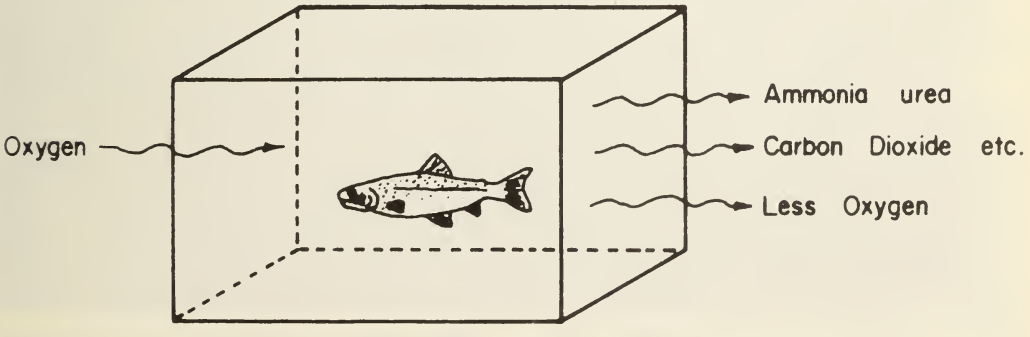
by Dr. R.W. McCauley
Waterloo Lutheran University

Periodically, the idea that "you can make a fortune" on raising trout leads the public to ask Department biologists, "How?". Such questions normally come from landowners who have a spring water source and who want to know how many fish can be raised. The prospective fish farmer is always asked what the minimum flow is during the year. More often than not, this has not been determined, and the property owner must return to the spring equipped with wash tub and stopwatch.

Apart from quality, the quantity of water decides whether any trout farming enterprise can be profitable. You can successfully raise trout in the basement of your home in Toronto, but the size of your water bill would make the operation unprofitable. Among fish-farmers, the unit of production for fish cultural purposes is considered to be the number of pounds of fish per year which can be raised in a flow of one gallon per minute. This figure depends, among other things, on the number of times the water is "used" by the fish.

Fish "use" water by removing part of the dissolved oxygen and by replacing it with some of the products of metabolism, notably carbon dioxide, amines, ammonia and urea. When the level of dissolved oxygen falls to five or six parts per million, the water is considered to be used once and is either discarded or conducted to other ponds for re-use. Experience in Ontario suggests a production of approximately 15 pounds of trout per gallon per minute, per year; when the water is used once at 50-60°F.

Production may be increased, of course, by using the water a second and even a third time. Dissolved oxygen may be restored almost to its original level by splashing it from a height of several feet into another pond. Splashing also serves to remove a good part of the dissolved carbon dioxide. Other waste metabolites containing nitrogen, however, remain almost without change in



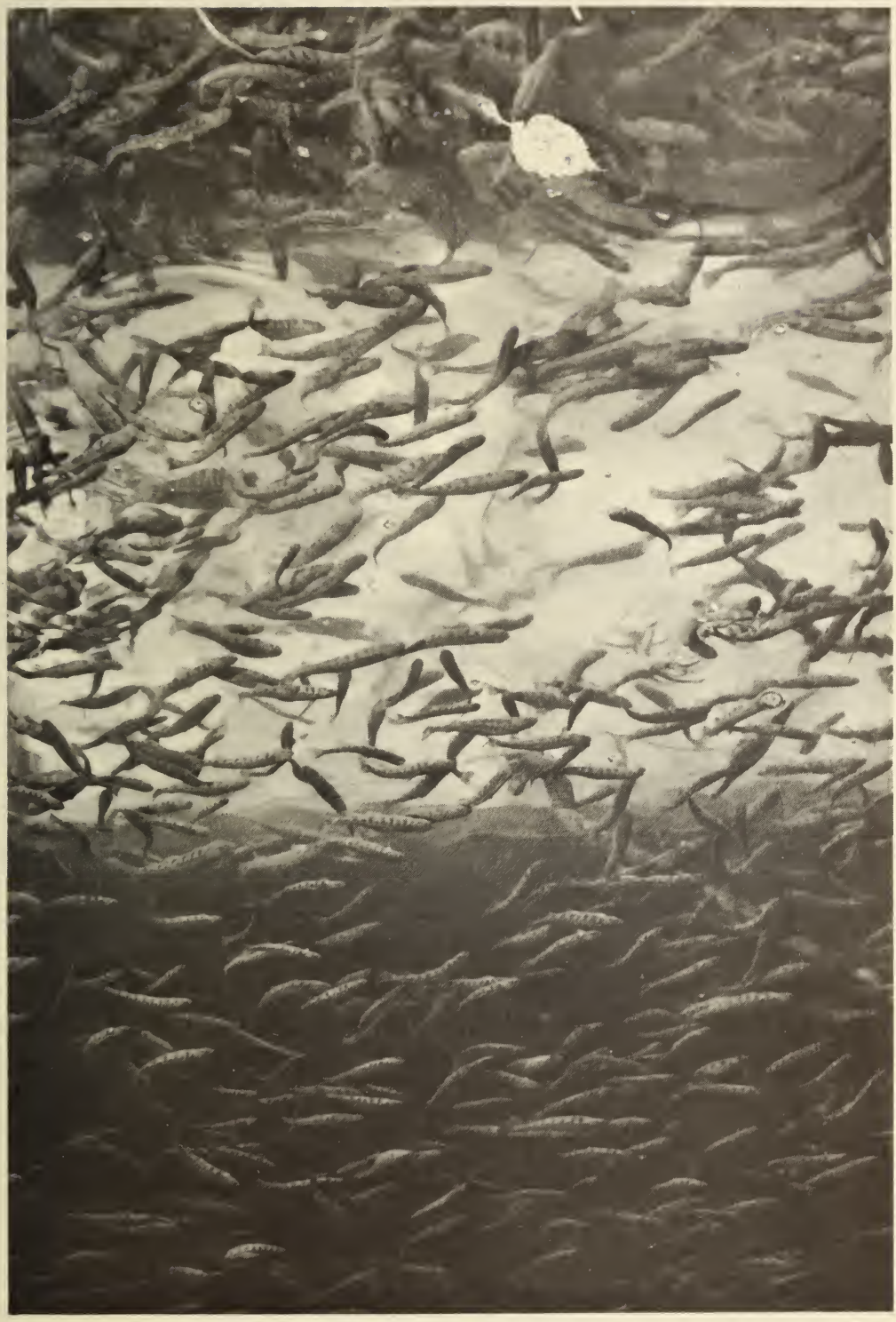
Fish "use" water.

Trout farming in your basement---possible but not profitable. Photo by T. Jenkins.

solution, and their steady accumulation imposes limits on the actual number of times water can be used without treatment. Under intensive culture, it is possible to re-use water several times and realize a production of about 50 pounds per gallon per minute, per year. However, at these high levels of production, the trout farmer is sailing close to the wind and must be on guard against diseases associated with poor water quality.

From time to time, reports of extremely high production are received from trout farms in Idaho, Denmark and Japan. This is the result, among other things, of the availability of large amounts of flowing, fresh water of temperature and quality suitable for growing trout. In Ontario, springs of large volume (over 1,000 gallons per minute) are rare, and these supply either provincial trout rearing stations or are in the hands of private trout farmers.

Production of trout in Ontario, under traditional methods, seems to be limited by the scarcity of springs of large volume. With the development of reliable water pumps accompanied by cheap power, the use of lake water may be economically feasible. Methods of heating, cooling, filtering and recirculating water have already been developed in experimental, fish cultural operations. Again, with the availability of cheap sources of energy, these techniques could be applied on a larger scale. The problems faced in fish culture are becoming similar to those of a world running short of fresh water for domestic and industrial uses.



Brook trout fingerlings at feeding time. Photo by T. Jenkins.